ON THE IMPACT OF EXTERNAL DEBT AND AID ON PUBLIC EXPENDITURE ALLOCATION IN SUB-SAHARAN AFRICA AFTER THE LAUNCH OF THE HIPC INITIATIVE

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Abstract
In the wake of the current financial and economic crises, the economies of Sub-Saharan Africa (SSA) find themselves squeezed between likely reductions in Official Development Assistance (ODA) and the pressing challenge to eradicate poverty. Public expenditure allocation to the social sector and to public investment is constrained by the need to pursue fiscal discipline, in order to avert debt distress. Within a framework of public expenditure choice (based on Fosu, 2007, 2008, 2010), the paper investigates the impact of the external debt-servicing constraint and external aid on government expenditure allocation in SSA countries after the launch of the HIPC initiative. Three-year panel over 1995-2009 for 40 low- and low-middle income SSA economies, of which 29 are HIPC, is used for the analysis. The findings suggest that the debt effect, while substantially lower than existing estimates for the pre-HIPC period, remains negative for the social sector, with education expenditure suffering the most from higher actual or predicted constraint-consistent debt servicing. ODA, particularly multilateral aid, has a significant positive effect on public investment. Moreover, recent relatively low levels of debt seem temporary and low-income countries are likely to contract additional debt to fill their funding gaps. This calls for appropriate measures, to be undertaken in order to prevent the deleterious effects of debt, especially on the social sector. The additional finding that government effectiveness favors public investment and spending in the social sector suggests that increased attention on governance is called for.

Keywords: SSA, HIPC, Public Expenditure Allocation, External Debt and Aid
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1. Introduction

The current global financial and economic crises are predicted to have spillover effects on developing countries in Sub-Saharan Africa (SSA), through capital flow and trade channels. Even though these countries were not affected by the first (i.e. financial) phase of the crises, they are likely to suffer from a financial shock because of the potential decrease in Official Development Assistance (ODA) and credit cost surge following the recession in the developed world (Fosu, 2010b). This would, thus, contribute to declining private capital flows and falling remittances, related to the economic difficulties and rising unemployment levels in the developed countries (Hern´andez & Gamarra, 2010; Kasekende, Brixova, & Ndikumana, 2010). In the meantime, SSA has already started experiencing shrinking volumes of exports, negatively affecting its terms of trade (International Monetary Fund, 2009). In fact, SSA current account balance, averaging 0.8 percent of GDP between 2004 and 2008, fell to -2.3 and -1.2 percent in 2009 and 2010, respectively (International Monetary Fund, 2011c: 3; 2011d: 95). The latest IMF projections indicate that the region's aggregate external balance would deteriorate in 2012 (-0.6 percent of GDP) following a slight improvement in 2011 (+0.6 percent of GDP; International Monetary Fund, 2011d: 95).

The joint crises were preceded by the fuel and food price shocks of 2007-08, which hit net oil-importing economies harshly and caused a drastic drop of SSA growth levels by some 70 percent between 2007 and 2009. Dampened growth expectations seemed to reverse the promising prospects for both GDP and its per capita recorded since the middle of the nineties (Fosu, 2010b). However, the region appears to have recovered quickly, taking advantage of the "macroeconomic policy space that [SSA] countries had created during the 2004-08 upswing" (International Monetary Fund, 2011c: 4). In fact, real GDP grew by 4.9 percent in 2010, and it is expected to expand further during 2011-12 (5.25-5.75 percent prediction; International Monetary Fund, 2011c: 4; 2011d: 93).

This relatively positive picture must be tempered, however. First, the current financial risks remain and, second, resurgent growth masks wide differences among countries. Most importantly, the full impact of the crises on poverty is yet to be fully realized, especially if

deteriorating fiscal positions lead governments to cut back on social programs that benefit the poor.

Furthermore, as low-income countries face worsening fiscal positions, there is the real concern that the recent progress on debt may be reversed. Hern'andez and Gamarra (2010: 424), for instance, showed that, "For given financial conditions, debt burden indicators deteriorate monotonically with the duration (severity) of the export shock." If so, then deeper export shocks could force SSA countries to incur additional borrowing and also to postpone the adoption of restrictive fiscal policies, thus reversing the progress on economic governance. Such an outcome would worsen debt burden indicators. Yet, if these countries managed to access new loans, financial conditions associated with these loans would likely be tightened, which could increase the risk of debt distress. Under tighter financial conditions, "The adjustments that governments would need to implement in fiscal expenditures [in particular, social expenditures and public investment] and taxes, in order to assure continuity in the service of their debts, are significantly larger (albeit lasting shorter)" (ibid.: 430). Meanwhile, the deteriorating fiscal positions in many of the development partners, occasioned by the crises, suggest that official development assistance (ODA) is likely to be curtailed.

Using pre-1995 data, Fosu (2007, 2008) shows that a binding predicted debt-servicing constraint, reflecting the liquidity constraint induced by the debt burden, would shift SSA government expenditure away from the social sector (education and health), while the effect of external aid on social-sector spending is positive, though lower than that of constrained debt servicing. Thus, deteriorating debt and ODA situations, occasioned by the crises, would be deleterious to social-sector allocation, with likely adverse implications for poverty. Moreover, Fosu (2010a) finds that ODA tends to increase public allocation toward public investment, so that decreasing ODA would have negative consequences for this form of investment that is often complementary to private investment.

The present paper may most appropriately be viewed as an extension of Fosu (2007, 2008, 2010a) empirical analysis to the post-1994 period during which HIPC was introduced, resulting in significant reductions in the debt-servicing requirements in most SSA countries. For example, on average, the debt servicing ratio (DSR) of SSA countries fell from about 14.0 percent in 1995 to nearly 5.0 percent in 2009. Thus, the debt constraint might be less binding during this more recent period. If so, then debt's effect would be attenuated. Of particular interest

additionally is if the impact of ODA on public expenditure allocation in the more recent post-HIPC period differs from that in the pre-HIPC era, especially given the greater emphasis on channeling aid towards budget support, a modality that would likely increase fungibility. Moreover, we explore herein the effects of other variables not included in the above studies, such as: government effectiveness, age dependency, and ethnic fractionalization. As a further departure, we pay considerable attention to the effect on debt servicing under HIPC. Furthermore, ODA is disaggregated into its source components of bilateral and multilateral aid, that is, in addition to its total value. Finally, we concentrate here on the social sectors of education and health as well as on public investment,[1] in order to highlight the high importance of these sectors for poverty reduction.[2]

Recent studies on the determinants of government expenditure and its size and composition changes include: (1) Okunade (2005) and Murthy and Okunade (2009), both of which analyze the determinants of health care expenditure in African countries; (2) Shelton (2007), for a cross-sectional and inter-temporal investigation of defense, education and health care expenditure variation at the central and local government levels, and for a set of over 100 countries); (3) Vergne (2009), for the electoral impact of the allocation of public spending in 42 developing countries. These studies either did not include any debt- or aid-related variables (Shelton, 2007) or included only aid and not debt-burden indicators (Murthy & Okunade, 2009; Okunade, 2005; Vergne, 2009). Lora and Olivera (2007), though, assess the effect of total public debt on health and education, and find that higher debt ratios reduce social expenditures. They nevertheless consider both social expenditure and interest debt payments as shares of GDP. As highlighted by Fosu (2010a: 381), "The use of expenditure shares [instead of shares of GDP] should reflect directly on the shift in the budget in response to changes in a given revenue component, particularly debt service." Expenditure shares should indeed project the priorities of public sector allocation. Ouattara (2006) includes debt servicing among the set of regressors for explaining the variation in government consumption and public investment expenditure; yet, the

[1] Gross domestic public investment (or gross fixed capital formation) includes outlays in addition to the stock of fixed assets of an economy (net of any sales of second-hand and scrapped fixed assets) by the government and non-financial public enterprises. Most outlays by government on military equipment are excluded. Thus, gross domestic fixed investment refers to land improvements (ex. fences, ditches, drains etc.), purchases of plant, machinery and equipment, construction of roads, railways, schools, offices, hospitals, private residential dwellings, commercial and industrial buildings and net acquisitions of valuables (World Bank, 2010a).

[2] We do not currently include agriculture, which is arguably an important sector for poverty reduction, mainly because data for that sector is quite sketchy.

study's contribution specifically falls within the fiscal response literature, typically focusing on the behavior of recipient governments in response to aid flows (Fosu, 2007, 2008, 2010a).

The present paper is organized as follows. Section two presents the theoretical framework, section three the empirical model; section four delineates the sample and data as well as estimate the constraining DSR; section five presents the estimation results for the government expenditure shares of education, health and public investment; and section six summarizes the main findings and then concludes.

2. Theoretical framework

The static theoretical model presented in this section follows the theoretical framework proposed by Fosu (2007, 2008; and, in particular, 2010a).

We assume that the government selects expenditure levels for each functional sector $(j = 1, \dots, J)$, G^j, so as to maximize a social welfare function, $U = U(G^1, G^2, \dots, G^J)$. Given that the functional arguments of U are in expenditure form, rather than quantities, we assume that the government provides utility to society through the delivery of consumable services.

Following the public choice literature, we may also consider that the government makes choices consistent with the preferences of the median voter, in order to maximize the probability of being re-elected. Nonetheless, this hypothesis could be too strong. In fact, "The median-voter model is probably unsuitable for developing countries […] where the democratic process is seldom at work. Instead, the social welfare function is likely to entail a weighted average of various political coalitions in the country" (Fosu, 2007: 703).

For J functional sectors, the government maximizes:

$$U(G^1, G^2, \dots, G^J) \quad (1)$$

$$s.t. \sum_J G^J = R \quad (2)$$

$$R = N + F - D \quad (3)$$

where R, the government revenue, is equal to the algebraic sum of N (the national/domestic revenue, both tax and non-tax), F (the foreign/external aid), and D (the debt service). Indicating with U_j the marginal utility of expenditure on sector $(j = 1, \dots, J)$, the first-order conditions, entailing indifference in spending among the J sectors, are:

$$U_1 = U_2 = \cdots = U_J \quad (4)$$

$$\sum_J G^J = R = N + F - D \quad (5)$$

If the properties of strict quasi-concavity for the social welfare function hold true,[3] we can derive the demand functions through the Implicit Function Theorem:

$$G^j = G^j(R^X; W), \quad j = 1, \dots, J \quad (6)$$

where R^X is the predetermined exogenous component of R, and W is a vector of regressors making the social welfare function country-specific.

Assuming that a given sector-commodity j is a normal good, we would expect $\partial G^j / \partial R^X > 0$. At the same time, from (5) we know that $\partial R^X / \partial D^X < 0$, where D^X is the component of debt service predetermined with respect to budgetary allocation decisions and measuring the liquidity constraint facing a country. We thus obtain $\partial G^j / \partial D^X < 0$ by the Chain Rule; in other words, the partial effect of the exogenous debt service D^X on the sector-specific expenditure G^j is expected to be negative for a normal good.

The debt service D would be exogenous if "debt servicing reflected past borrowing decisions and borrowers honoured previously established contracts" (Fosu, 2007: 704). Yet, if governments can decide to default on their debt commitments (when the penalty associated to the default is less than the shadow price of debt service) or to reschedule their debt, D and R become endogenous. If this happens, actual debt service payments and real debt-servicing requirements may not reflect one another (this is further specified in the next sections). Similarly, N (the tax and non-tax domestic revenue) is likely to be endogenous to government spending, and it shall consequently be omitted from the estimation.

Focusing only on the exogenous components of R, we specify the demand functions for the J sectors as:

$$G^j = G^j(D^X, F; W), \quad j = 1, \dots, J \quad (7^j)$$

[3] If $J = 2$, namely the social sector (SS, health and education) and public investment (PI), with no residual 'others' category, the second-order conditions are:
$U_{SS} < 0, U_{PI} < 0, and\ U_{SS}U_{PI} > U_{SSPI}$
with U_{SS}, U_{PI} and U_{SSPI} second-order partial utilities.

3. The model

From 7^j, we estimate the reduced-form set of equations,[4]

$$g^j = g^j\left(D^X, F; \mathbf{W};\ u^j\right), \quad j = 1, \ldots, J \qquad (8^j)$$

where $J = 3$ for the three sectors of interest: education, health and public investment. g^j is the j sector's share of public expenditure. **W** is a set of control variables defining the country's social welfare function[5] and u^j is the stochastic error term. We now discuss the expected signs of the effects for these covariates.

3.1. The main exogenous variables

These include:

D^X, Exogenous component of the debt service

The effect of this variable is generally ambiguous, depending on the Engel properties of the j sector and whether the consumable service provided by that sector is deemed by the government to be a normal or an inferior good (e.g., Fosu, 2010a). However, the effect would likely be negative if the sector was considered to be of relatively low priority in the public budgeting process (ibid.).

F, Foreign aid share of GDP

In general, the effect of ODA on government expenditure allocation will depend on the conditionality attached by donors to the foreign assistance they provide, as well as on the degree of aid fungibility that allows recipients to allocate public expenditure according to their own priorities (ibid.). Despite donors' apparent preference for allocation toward the social sector during the HIPC era, the increasing use of the budget-support modality is likely to enhance fungibility and to reduce the ODA impact on the social sector. In this paper, we control for both the total ODA and for multilateral and bilateral aid separately.

[4] A reduced-form model instead of a structural model is estimated, since the decision-making process that defines the latter is often not well understood (for details see, for instance, Fosu, 2007, 2008, 2010a).

[5] The government decision maker is assumed to optimize a social welfare function in its public provision decisions, see ibid.

3.2. Control variables, generally defined by the parameters of the social welfare function

These include:

Q, Gross National Income (GNI) per capita

The inclusion of GNI per capita in the model is intended to reflect the tendency of the social welfare function to favor certain types of public provision at higher levels of development. Mahdavi (2004: 1141), for example, suggests that in the course of economic development public expenditure is likely to be diverted away from investments in infrastructure and human capital (with the private sector replacing the public sector), and towards the financing of social safety nets and income maintenance programs.

G, Government effectiveness indicator

We introduce an indicator for government effectiveness to capture the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Keefer and Knack (2007) observe that public investment is dramatically higher in countries with limited political checks and balances, low-quality governance or no competitive elections.[6] Similarly, greater government effectiveness could lead to a better reflection of societal preferences on average, so that a relatively optimal public expenditure mix is likely to be adopted. In general, without further knowledge of societal preferences, the effect of government effectiveness on expenditure allocation could not be appropriately signed. Nevertheless, greater government effectiveness should reduce the tendency of corrupt governments to tilt spending in favor of capital that is more prone to rent-seeking.

A, Age structure of the population

The age structure of the population is captured by the age dependency ratio for people younger than 15 or older than 64. The demand for health services is expected to be higher the greater the number of people below the age of 15 or above 64, nonetheless both Gbesemete and Gerdtham (1992) and Fosu (2008) find results contradicting with this common view. Likewise, the subpopulation below 15 potentially increases school enrollment and the demand for public

[6] Keefer and Knack (2007: 567) measure public investment as central government expenditure (including current and capital) for transport and communication. This is a proxy for expenditure in economic infrastructure, and it is derived from the Government Finance Statistics (GFS) of the International Monetary Fund. In this paper, however, we define public investment as specified in note 1 above.

education services. Its impact on public education expenditure is generally unclear, though. Glick and Sahn (2006), for example, report that public education systems in African countries have suffered from severe revenue shortfalls during a time when the school age population has grown rapidly, in part as a consequence of economic stagnation since the early 1980s until recently. Given that relatively high growth was recorded for SSA countries generally from the mid-nineties, however, we would expect a positive coefficient association with the age dependency ratio in the education expenditure estimation.[7]

E, Ethnic fractionalization

Mauro (1995: 693) shows the existence of a significant correlation between ethnolinguistic fractionalization and corruption in the public sector. Bureaucrats have tended to favor members of their own groups and to give emphasis to categories of government expenditure more prone to rent-seeking behavior, and away from social expenditure (Delavallade, 2006). Kimenyi (2006) also argues that ethnicity reduces provision of public goods in Africa. Annett (2001) additionally demonstrates that increasing levels of consumption are used as partial insurance against the risk of greater political instability and conflict, induced by higher fractionalization. In particular, Miguel (2004) finds that higher ethnic diversity is associated with lower funding for primary education in Kenya.

4. Sample, data and descriptive statistics

The sample includes 40 low-income and lower-middle-income SSA countries for the period 1995-2009. Of these 40 countries, 29 are Highly Indebted Poor Countries (HIPC). Table 1a shows the countries that achieved the HIPC decision point (DP)[8] between 1995 and 2009. Most

[7] Note that though the age dependency variable used here also includes the share of the population above 64 years, it is swamped by the youth component. In fact, between 1995 and 2009, the ratio of younger dependents (people younger than 15) to the working age population (those ages 15-64) averaged 81.8 percent, whereas the ratio of older dependents (people older than 64) to the working-age population averaged 5.8 percent in SSA developing countries (World Bank, 2011).

[8] The decision point (DP) is the first stage of qualification for debt relief under the HIPC initiative. At this point, the qualifying country must have "a current track record of satisfactory performance under IMF and International Development Association (IDA)-supported programs, a Poverty Reduction Strategy (PRS) in place, and debt burden indicators that are above the HIPC initiative thresholds using the most recent data for the year immediately prior to the decision point" (World Bank, 2009). At the DP, the country will also agree on a list of completion point triggers (including a continued track record of satisfactory performance on an IMF program and the implementation of the PRS for at least one year), achieving which will allow the country to 'graduate' from the HIPC initiative (ibid.). In

of the HIPC SSA economies were deemed eligible for interim relief on their debt service falling due sometime between 1995 and 2009, but the DP was attained at different times.

Table 1a **Country coverage: HIPC SSA countries included in the sample**

Countries that achieved the HIPC Decision Point (DP) between 1995 and 2009

Benin	*July 2000*	Madagascar	*December 2000*
Burkina Faso	*July 2000*	Malawi	*December 2000*
Burundi	*August 2005*	Mali	*September 2000*
Cameroon	*October 2000*	Mauritania	*February 2000*
Central African Republic	*September 2007*	Mozambique	*April 2000*
Chad	*May 2001*	Niger	*December 2000*
Congo, Dem. Rep.	*July 2003*	Rwanda	*December 2000*
Congo, Rep.	*March 2006*	Sao Tome and Principe	*December 2000*
Cote d'Ivoire	*March 2009*	Senegal	*June 2000*
Ethiopia	*November 2001*	Sierra Leone	*March 2002*
Gambia, The	*December 2000*	Tanzania	*April 2000*
Ghana	*February 2002*	Togo	*November 2008*
Guinea	*December 2000*	Uganda	*February 2000*
Guinea-Bissau	*December 2000*	Zambia	*December 2000*
Liberia	*March 2008*		

Notes: Source for table 1a: United Nations (2011).

Table 1b reports the countries that reach the DP later than 2009 (i.e. Comoros) or that are eligible for the HIPC debt relief but have yet to achieve the DP (i.e. Eritrea, Somalia and Sudan) or do not qualify for the HIPC. The HIPC was established in September 1995 and officially endorsed by the World Bank, the IMF, the Paris Club and bilateral donors in 1996, with 'enhanced' HIPC introduced in 1999; 2009 is the last year of data availability for the majority of variables and countries.

the meantime, many participating multilateral and bilateral creditors will begin to provide debt relief. Hence, 67 percent stock reduction is approved at the DP, in addition to 67 percent flow reduction granted under the Naples terms in the three years prior to the DP achievement. If the debt condition remains unsustainable after the full application of the traditional debt relief mechanisms, the HIPC country will be granted further debt cancellation by bilateral creditors as well as multilateral relief under the Cologne terms (International Monetary Fund, 2011a).

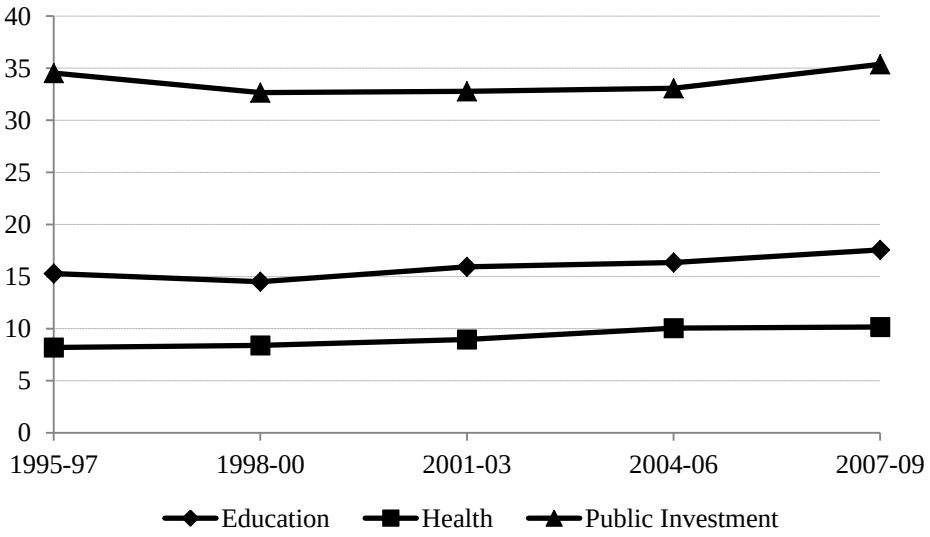
***Table 1b* Country coverage *(cont.)*: Other SSA Countries included in the sample**

Angola	Nigeria
Cape Verde	Somalia *(Eligible for HIPC debt relief)*
Comoros *(HIPC DP achieved in June 2010)*	Sudan *(Eligible for HIPC debt relief)*
Eritrea *(Eligible for HIPC debt relief)*	Swaziland
Kenya	Zimbabwe
Lesotho	

Notes: Source for table 1b: United Nations (2011).

Data sources and summary statistics for the variables used in the analysis are reported in the appendix table. Figure 1 depicts the trends in sector expenditure shares for three-year panel non-weighted averages between 1995 and 2009.

***Figure 1* Trends in education, health and public investment expenditure shares**
40 SSA countries, 1995-2009



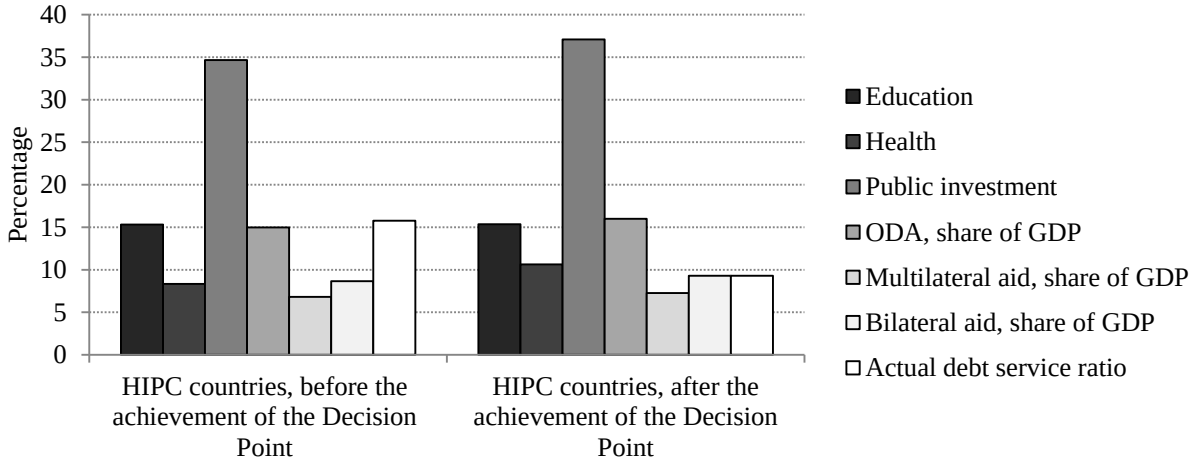
Notes: Non-weighted means of government expenditure shares.
Data sources: World Bank (2010a, 2011).

The shares of social spending on health and education followed a generally upward trend during 1995-2009; public investment share declined until 1998, remained stable between 1998 and 2004 and started increasing thereafter. Overall, inter-temporal government expenditure differences were limited, with the greatest variation equal to +2.30 percentage points recorded for public investment spending between 2004/06 and 2007/09. Cross-sectional variation was more pronounced: While the Angolan government allocated on average 4.79 percent of its total

budget to education (arithmetic mean for the entire period 1995-2009), the government of Lesotho assigned to this sector 25.58 percent of its overall expenditure. The gap is narrower for the health share, with the minimum 3.28 percent in Eritrea and maximum 14.46 percent in Mozambique, but much larger for the public investment share, with 13.65 percent in Zimbabwe and 54.67 percent in Chad.

Figure 2 **Average expenditure shares, aid (share of GDP) And ACTDSR (share of exports) for HIPC countries**

Comparison before and after the achievement of the HIPC Decision Point



Notes: Source of descriptive statistics: Authors' compilation.

Figure 2 compares government expenditure shares, aid allocated by multilateral and bilateral donors (percentage of GDP), and actual debt service ratio (ACTDSR) for HIPC countries before and after the achievement of the decision point (DP). Expenditure shares generally increased after the DP was reached, and this is particularly the case for public investment (+2.42 percentage points) and health (+2.29 percentage points). This may be related to the positive impact of the HIPC on social sector expenditure given the emphasis placed by the initiative on social spending towards poverty reduction.[9]

The HIPC initiative may have benefitted SSA low- and low-middle income countries both through a DSR-reduction channel and through an ODAGDP-increase channel. Bilateral aid to HIPC economies increased more than multilateral aid (+0.64 as compared to +0.44 percentage points) after the achievement of the HIPC DP, which suggests that bilateral donors (most of all,

[9] To be considered for the HIPC assistance, a country must have developed a Poverty Reduction Strategy Paper (PRSP).

DAC donors) welcomed the improvement in the debt-position of the mostly indebted poor countries. Meantime, the ACTDSR dropped by 6.47 percentage points, which may be due not only to the reduction of the debt burden towards sustainable levels prompted by the HIPC, but also to the HIPC requirement to clear all arrears to multilateral donors before the Decision Point and avoid accumulating new arrears thereafter (Martin & Johnson, 2001).

4.1. Debt service estimation

In order to assess the impact of debt service on the allocation of government expenditure in the sample of SSA countries, we first proceed by estimating a more reliable measure of the liquidity constraint induced by debt service payments. Actual payments may reflect the ability and/or un/willingness of a country to pay, more than the effective debt-servicing burden that the country is facing (Fosu, 2007, 2008, 2010a). The ACTDSR is thus regressed on the NETDEBTX (net debt as a share of exports) that is the difference between the public and publicly-guaranteed debt stock and international reserves. "In effect, a larger debt outstanding signifies larger debt-servicing obligations, *ceteris paribus,* whereas a higher level of international reserves indicates that the country has a greater ability to service its debt, rendering the debt constraint less binding" (Fosu, 2008: 369). The appendix table describes the variables that enter the DSR estimations, their sources and summary statistics.

We first replicate Fosu (2007, 2008, 2010a) approach and estimate debt *Equation 1a*.

Equation 1a $\text{ACTDSR} = \beta_0 + \beta_1 \text{NETDEBTX} + \varepsilon$

Regression results are reported in table 2. Hansen and Breush-Pagan LM statistics suggest that RE is to be preferred to both OLS and FE. Interestingly, the estimate of the NETDEBTX coefficient $\hat{\beta}_1$ of 0.016 in table 2 is about the same as that of 0.015 reported by Fosu (2007, 2008, 2010a) for a slightly different sample of SSA countries and a different time period (1975-1994 vs. 1995-2009 currently), with both estimates highly significant (z statistics: 4.31 for 1975-1994 vs. 7.79 currently). The coefficient of determination (0.456) suggests a slightly lower level of fit, though, than that implied by an estimate of 0.597 for 1975-1994 (ibid.).

***Table 2* Panel regression results: RE estimation of ACTDSR**

Dependent Variable = ACTDSR (percentage)		
	Unit	
NETDEBTX	Percentage	0.016***
		(7.79)
Constant		5.694***
		(3.94)
Observations		138
RSQ		0.456
Sargan- Hansen		1.15(0.28)
Breusch-Pagan LM		14.09(0.00)

Notes: Regression with cluster robust standard errors; z statistics in parentheses.
RSQ is the coefficient of determination. The Sargan-Hansen (or Hansen's J) statistic is a test statistic for overidentifying restrictions,[10] which is robust to arbitrary heteroskedasticity; the restrictions hold under the null. Additionally, the statistic is robust to within-group correlation because the estimation is conducting by clustering within countries. The J statistic is asymptotically distributed as chi-square with degrees of freedom equal to the number of overidentifying restrictions (Baum, 2006: 201). The Breusch-Pagan LM represents the Lagrangian multiplier test to choose between RE and pooled-OLS models. LM tests the null hypothesis of cross-equation error independence and is asymptotically distributed as chi-square with degrees of freedom equal to unity. Hansen and Breusch-Pagan LM statistics suggest that RE is to be preferred to both FE and OLS.
** p < 0.10, ** p < 0.05, *** p < 0.01*

As a departure from Fosu (2007, 2008, 2010a), however, we subsequently introduce year dummies in the DSR regression, with the aim of accounting for possible temporal effects. In particular, we expect that the HIPC initiative would reduce debt levels over time. *Equation 1b* is specified as follows,

Equation 1b $$\text{ACTDSR} = \beta_0 + \beta_1 \text{NETDEBTX} + \beta_2 \text{Yrs98\_00} + \cdots + \beta_5 \text{Yrs07\_09} + \varepsilon$$

Table 3 reports the estimated coefficients. As the Sargan-Hansen test statistic rejects the joint significance of overidentifying restrictions, the FE results are shown this time. The year coefficients, jointly statistically significant at the 1 percent level (see F-statistic for time effects), indicate that the Debt Service Ratio (DSR) decreased through time from the base period (i.e. three-year average 1995-1997). We derive table 4 from table 3, in order to show marginal changes for significant time dummies' coefficients. The changes suggest that ACTDSR dropped particularly after 2000, when the majority of HIPC countries qualified for the HIPC DP (see

[10] In order to select between Fixed Effects (FE) and Random Effects (RE) estimators, we recall that the additional orthogonality conditions assumed under RE are overidentifying restrictions (Schaffer & Stillman, 2010).

table 1a), and after the launch of the Multilateral Debt Relief Initiative (MDRI) in the second half of 2005.[11]

***Table 3* Panel regression results: FE estimation of ACTDSR with year dummies**

Dependent Variable = ACTDSR (percentage)	Unit	
NETDEBTX	Percentage	0.013***
		(3.46)
Yrs98_00	Yes=1	-1.814
		(-1.55)
Yrs01_03	Yes=1	-3.918***
		(-2.76)
Yrs04_06	Yes=1	-3.149*
		(-1.91)
Yrs07_09	Yes=1	-6.095***
		(-5.49)
Constant		8.861***
		(5.81)
Observations		138
RSQ		0.556
Sargan- Hansen		25.71(0.00)
F-test for Time Effects		14.49(0.00)

Notes: Regression with cluster robust standard errors; t statistics in parentheses.
** p < 0.10, ** p < 0.05, *** p < 0.01*
See table 2 for other notes.

***Table 4* Marginal changes of estimated coefficients for time dummies**

	Value of the coefficient	Marginal change
1995-1997	8.861	-
1998-2000	8.861	-
2001-2003	4.943	-3.918
2004-2006	5.712	0.769
2007-2009	2.766	-2.946

Notes: Source: Own computations based on table 3 estimation results.

[11] Launched in June 2005, and first proposed by the G-8, the Multilateral Debt Relief Initiative (MDRI) foresees 100 percent cancellation of debt claims by the International Monetary Fund (IMF), the International Development Association (IDA) of the World Bank, and the African Development Fund (AfDF) on countries that qualified (or will eventually) for the completion point under the HIPC (at which debt relief from HIPC-participating creditors becomes irrevocable; World Bank, 2009). As stated by the IMF, "Unlike the HIPC Initiative, the MDRI does not propose any parallel debt relief on the part of official bilateral or private creditors or of multilateral institutions beyond the IMF, IDA, and the AfDF". Nonetheless, the Inter-American Development Bank provided similar debt relief to the five HIPCs in the Western Hemisphere in early 2007 (International Monetary Fund, 2011b).

To reflect more accurately the impact of the HIPC debt relief on debt servicing, we drop the time dummy variables and introduce a decision point (DP) year dummy variable (HIPC_DP). For a HIPC country, HIPC_DP equals '1' from when the country achieved the DP (sometime between 1995 and 2009), and '0' for the years preceding the achievement. In the meantime, HIPC_DP is set to '0' for HIPC countries that qualified for the DP after 2009 and for non-HIPC countries. *Equation 1c* follows.

Equation 1c $\text{ACTDSR} = \beta_0 + \beta_1 \text{NETDEBTX} + \beta_2 \text{HIPC\_DP} + \varepsilon$

The RE results, which are preferred on the basis of the Hansen's *J* statistic and the Breusch-Pagan LM statistic, are reported in table 5. The results show that achieving DP under the HIPC reduced the debt burden by an average of 3.13 percentage points.

Table 5 **Panel regression results: RE estimation of ACTDSR with HIPC_DP**

Dependent Variable = ACTDSR (percentage)	Unit	
NETDEBTX	Percentage	0.014***
		(6.32)
HIPC_DP	Yes=1	-3.131**
		(-2.25)
Constant		7.641***
		(5.01)
Observations		138
RSQ		0.460
Sargan- Hansen		1.75(0.42)
Breusch-Pagan LM		15.54(0.00)

Notes: Regression with cluster robust standard errors; z statistics in parentheses.
** p < 0.10, ** p < 0.05, *** p < 0.01*
See table 2 for other notes.

We use the results in table 5 to predict the debt service ratio (PREDSR), and then compare the ACTDSR with the PREDSR in table 6. The ACTDSR has a slightly smaller average, but a larger standard deviation (SD) than the PREDSR; the larger SD associated with ACTDSR could indicate that the "debt-servicing ratio is a poor indicator of the debt burden" due to 'noise'; otherwise the greater standard error should lead to greater precision of the ACTDSR coefficient (Fosu, 2010a: 384 and 390 note 23).

***Table 6* ACTDSR versus PREDSR; Comparison**

Variable	Observations	Mean	Std. Dev.	Min	Max
ACTDSR	138	10.93	9.78	0.11	49.60
PREDSR	138	11.51	7.00	4.29	41.90

Notes: Source: Own computations.

The role of the HIPC initiative in possibly relieving the liquidity constraint of debt is further investigated by focusing on the subsample of countries that qualified for the HIPC between 1995 and 2009 (see table 1a for a list of these economies). We suspect that the longer the time elapsed since a country achieved the HIPC DP, the smaller the DSR. We test this hypothesis below in *Equation 2*, where DSR is regressed on NETDEBTX, HIPCDPYrs (the number of years from the attainment of the HIPC DP, zero prior to DP) and HIPCDPYrs^2 (HIPCDPYrs squared).

Equation 2 $\mathrm{DSR} = \gamma_0 + \gamma_1 \mathrm{NETDEBTX} + \gamma_2 \mathrm{HIPCDPYrs} + \gamma_3 \mathrm{HIPCDPYrs\hat{}2} + \mathrm{u}$

Results are reported in table 7.

***Table 7* Panel regression results: RE estimation of ACTDSR With HIPCDPYrs and its square**

Dependent Variable = ACTDSR (percentage)	Unit	
NETDEBTX	Percentage	0.015***
		(7.38)
HIPCDPYrs	N. of Years	-1.314**
		(-2.51)
HIPCDPYrs^2	Square	0.103*
		(1.89)
Constant		7.799***
		(3.61)
Observations		101
RSQ		0.57
Sargan- Hansen		1.22(0.75)
Breusch-Pagan LM		3.49(0.06)

Notes: Regression with cluster robust standard errors; z statistics in parentheses.
** p < 0.10, ** p < 0.05, *** p < 0.01*
See table 2 for other notes.

As expected, ACTDSR falls as the elapsed time from the achievement of the decision point under HIPC increases (see the negative coefficient for the HIPCDPYrs variable). Nonetheless, the coefficient associated with the quadratic term HIPCDPYrs^2 is positive (and significant at the 10 percent level), suggesting that the reduction in debt servicing is at a decreasing rate. Hence, the impact of the HIPC initiative on the DSR seems to fade away with time. Indeed, the results of table 7 suggest that the turning point is roughly 6 years (that is, 1.314/0.206).

5. Estimation of equations: education, health and public investment expenditure shares

We now proceed with the estimation of the expenditure share equations involving education, health and public investment. We use in turn both the actual debt-servicing rate, ACTDSR, and the predicted debt-servicing, PREDSR derived from *Equation 1c*. If the HIPC initiative did indeed relieve the debt-servicing constraint, then there should not be a significant difference using either measure. Also included in the models are the aid variable, ODAGDP, and the other (control) variables.

Three-year data averaging is introduced in order to minimize non-systematic errors (Fosu, 2010a: 385).[12] Given that the number of time periods ($T=5$) is much smaller than the number of countries ($N=40$) and the main requirement for large-sample approximations ($T > N$) is not met for simultaneous estimation (Baum, 2006), we estimate equations 8^j separately for $j = 1,2,3$ (education, health and public investment). Furthermore, we opt for the RE results, given tests based on the Sargan-Hansen and the Breusch-Pagan LM statistics (see table 8). We also use cluster-robust standard errors (clustering within countries). Regression results are presented in table 8. The rather small sample sizes, particularly the case for education expenditure shares,[13] are due to missing data.

As in previous studies (e.g., Fosu, 2010a), the debt-constrained variable PREDSR exhibits a negative sign in both the health and education expenditure share equations. Unlike previous estimates for 1975-1994 (ibid.: table 2), however, the estimated coefficients for 1995-

[12] Fosu (2010a) considers five-year instead of three-year averaging given the longer time period (20 instead of 15 years) available for his analysis.

[13] For education, missing values are found mainly for Angola, Burkina Faso, Comoros, the Democratic Republic of Congo, Guinea-Bissau, Liberia, Mozambique, Nigeria, Sao Tome and Principe, Somalia, Sudan, Tanzania and Zimbabwe.

2009 are quite small in magnitude (education: -0.258 vs. -1.497; health: -0.098 vs. -1.824). Indeed, the current coefficient is not even significant in the case of health. Using the actual debt-servicing payment ACTDSR, instead of PREDSR, also results in negative coefficients with small magnitudes, and even smaller than those of PREDSR. Nonetheless, the fact that the ACTDSR coefficients are statistically significant, unlike those for the pre-HIPC period (ibid.), suggests that the 'noise' in actual debt servicing is minimal, in the sense that ACTDSR may now reasonably accurately reflect a country's payment obligations and, hence, its debt burden. According to the present results, a higher level of debt servicing still implies lower allocations into the education and health sectors, but at much lower rates than in the pre-HIPC era.

***Table 8* Panel regression results: RE estimations of Education, health and public investment expenditure shares with PREDSR and ACTDSR**

Dependent Variable = Logarithmic sector expenditure shares		**Estimations with PREDSR**			**Estimations with ACTDSR**		
	Unit	1. Education	2. Health	3. Public Investment	4. Education	5. Health	6. Public Investment
PREDSR or ACTDSR	Ln	-0.258***	-0.098	-0.007	-0.133***	-0.071**	0.042
		(-2.85)	(-1.41)	(-0.09)	(-2.92)	(-2.16)	(1.14)
ODAGDP	Ln	-0.102	0.027	0.229**	0.007	0.070	0.210**
		(-1.28)	(0.46)	(2.44)	(0.08)	(1.21)	(2.37)
PCGNI	Ln	-0.278*	-0.070	0.001	-0.156	-0.042	0.033
		(-1.77)	(-0.47)	(0.01)	(-1.10)	(-0.31)	(0.30)
GOVEFF	[-2.5,2.5]	0.227**	0.160	0.160*	0.249**	0.174	0.153*
		(2.36)	(1.48)	(1.89)	(2.48)	(1.64)	(1.82)
AGEDEP	Ln	-1.318**	-0.060	-0.245	-1.074	0.020	-0.273
		(-2.13)	(-0.14)	(-0.50)	(-1.62)	(0.05)	(-0.55)
ETHNIC	[0,1]	-0.686**	-0.436	0.005	-0.504*	-0.367	0.032
		(-2.41)	(-1.45)	(0.02)	(-1.71)	(-1.30)	(0.10)
Constant		11.695***	3.373	4.154*	9.214***	2.635	4.018*
		(3.47)	(1.26)	(1.73)	(2.69)	(1.05)	(1.66)
Observations		85	108	101	85	108	101
RSQ		0.272	0.227	0.241	0.271	0.300	0.222
Sargan-Hansen		4.49(0.48)	5.85(0.32)	5.02(0.413)	4.80(0.44)	5.46(0.36)	6.91(0.23)
Breusch-Pagan LM		20.01(0.00)	39.92(0.00)	34.52(0.00)	19.02(0.00)	23.28(0.00)	35.89(0.00)

Notes: All estimations are Random Effects regressions with cluster robust standard error; z statistics in parentheses.
RSQ is the coefficient of determination. Sargan-Hansen is a test statistic to select between FE and RE; overidentifying restrictions, assumed under RE, hold under the null. The statistic is asymptotically distributed as chi-square with degrees of freedom equal to the number of restrictions (Baum, 2006: 201). Breusch-Pagan LM tests the null hypothesis of cross-equation error independence (that is pooled-OLS is to be preferred to RE), and is asymptotically distributed as chi-square with degrees of freedom equal to unity.
** p < 0.10, ** p < 0.05, *** p < 0.01*

As the results in table 8 further suggest, Official Development Assistance (ODA), measured by ODAGDP, does not seem to significantly alter the allocation for health or education. This outcome differs from that obtained by other studies. For example, Fosu (2010a)

and Ouattara (2006) both find a positive effect of aid in these sectors. That aid may no longer affect allocation to these social sectors may simply reflect the possibility of higher fungibility of ODA, especially in the light of the increasing direction of aid toward budget support in recent years. However, as in the case of Fosu (2010a) and Ouattara (2006), for example, ODA apparently exercises a positive effect on the expenditure share for public investment. The estimated aid impact for public investment is remarkably similar: 0.215 for 1975-1994 (Fosu, 2010a, table 2), compared to the present estimates for 1995-2009 of 0.229 and 0.210 reported in columns 3 and 6 of table 8, respectively.

Considering the other covariates, we note that the effect of development level as measured by per capita income, PCGNI, is generally insignificant across the three sectors. Similar results were obtained in Fosu (2010a, table 2), for instance, though the coefficient of PCGNI was weakly positive for education in that study for 1975-1994, in contrast to the weakly negative impact in the present 1995-2009 sample. Madhavi (2004) also found that public spending in human capital suffers after an increase in the level of national (per capita) income. The low precision of the estimate in either study suggests that it is difficult to identify education as either 'luxury' or 'non-luxury'.[14]

Public spending on education is also negatively related to age dependency, though with reasonable statistical significance only in the model with PREDSR, column 1. As observed above, AGEDEP, which is the fraction of the population below 15 years of age or above 64 to the working age population, is heavily weighted toward the former (school) age group. Our result is similar to that in Dreher, Nunnenkamp and Thiele (2006).

In the case of ethnic fractionalization, we estimate negative coefficients of ETHNIC for both education and health, though only the former is statistically significant. In particular, the coefficient for education is statistically significant at the 5 percent level in the regression with PREDSR, and at the 10 percent level in the regression with ACTDSR. The results corroborate the current literature suggesting that ethnic fractionalization tends to reduce public provision (e.g., Kimenyi, 2006; Miguel, 2004). That the negative effect of ETHNIC is quite significant for education is particularly supportive of Miguel's empirical finding that ethnic fractionalization reduced funding for primary education in Kenya.

[14] An increase in PCGNI would shift the expenditure in favor (against) if 'luxury' ('non-luxury') sector; for details see, e.g., Fosu (2010a).

Government effectiveness, GOVEFF, exhibits positive coefficients in all three sectors, though most significantly for education and public investment. In the case of education, this finding corroborates the view that improvement in governance would reduce corruption and direct public expenditure toward the non-capital-intensive sectors (Fosu, 2010a), consistent with Keefer and Knack (2007) and Rajkumar and Swaroop (2008). However, the current result is not consistent with this view if public investment is capital-intensive, unless societal preferences require relatively high levels of public investment and greater government effectiveness reflects such preferences.

We now check the robustness of the above results, especially as related to aid, by disaggregating ODA into multilateral aid, bilateral aid, and bilateral aid from DAC countries. With the Sargan-Hansen and the Breusch-Pagan LM test statistics favoring RE estimation over the FE and OLS alternatives, RE results are presented in tables 9 and 10; the debt-servicing measures are the 'debt-constraining' variable, PREDSR, and actual debt servicing, ACTDSR.

The results corroborate those in table 8. In particular, the effect of ODA remains positive for public investment regardless of the aid type (multilateral, bilateral, or DAC), though the precision of the estimate appears greatest when the ODA variable is multilateral aid, perhaps because the African countries' ODA is often dominated by this aid type. We observe, furthermore, that the findings for the effects of the other covariates remain intact. In particular, the debt-servicing impacts, whether measured by PREDSR or ACTDSR, are about the same across ODA types and are similar to our respective estimates in table 8 when aggregate ODA was used.

Table 9 Robustness check – Panel regression results: RE estimations of social sector and public investment expenditures with PREDSR

Dependent Variable = Logarithmic sector expenditure shares		**Estimation with MULTILATERAL AID**			**Estimation with BILATERAL AID**			**Estimation with DAC AID**		
	Unit	1a. Education	2a. Health	3a. Public Investment	1b. Education	2b. Health	3b. Public Investment	1c. Education	2c. Health	3c. Public Investment
PREDSR	Ln	-0.257***	-0.095	-0.007	-0.248***	-0.101	-0.015	-0.248***	-0.101	-0.013
		(-2.79)	(-1.36)	(-0.08)	(-2.81)	(-1.43)	(-0.18)	(-2.81)	(-1.43)	(-0.16)
Aid share of GDP	Ln	-0.076	0.042	0.223***	-0.039	0.004	0.175*	-0.030	-0.001	0.168*
		(-1.08)	(0.86)	(2.82)	(-0.46)	(0.07)	(1.94)	(-0.38)	(-0.03)	(1.91)
PCGNI	Ln	-0.268*	-0.058	0.006	-0.226	-0.085	-0.053	-0.220	-0.088	-0.056
		(-1.69)	(-0.39)	(0.06)	(-1.50)	(-0.59)	(-0.49)	(-1.45)	(-0.62)	(-0.52)
GOVEFF	[-2.5,2.5]	0.236**	0.150	0.156*	0.178**	0.174*	0.213***	0.174**	0.176*	0.215***
		(2.40)	(1.34)	(1.85)	(2.01)	(1.75)	(2.62)	(2.00)	(1.79)	(2.68)
AGEDEP	Ln	-1.285**	-0.096	-0.425	-1.309**	-0.076	-0.276	-1.311**	-0.082	-0.263
		(-2.03)	(-0.23)	(-0.89)	(-2.10)	(-0.18)	(-0.55)	(-2.11)	(-0.19)	(-0.52)
ETHNIC	[0,1]	-0.723**	-0.418	0.104	-0.659**	-0.442	-0.063	-0.660**	-0.441	-0.064
		(-2.54)	(-1.36)	(0.36)	(-2.19)	(-1.47)	(-0.19)	(-2.17)	(-1.46)	(-0.19)
Constant		11.387***	3.447	5.089**	11.113***	3.610	4.931**	11.073***	3.660	4.901**
		(3.36)	(1.31)	(2.17)	(3.30)	(1.38)	(2.08)	(3.27)	(1.41)	(2.08)
Observations		84	107	100	85	108	101	85	108	101
RSQ		0.270	0.208	0.273	0.230	0.217	0.211	0.225	0.214	0.206
Sargan-Hansen		5.18(0.39)	4.79(0.44)	4.30(0.51)	6.17(0.29)	6.60(0.25)	6.26(0.28)	6.08(0.30)	6.91(0.23)	6.31(0.28)
Breusch-Pagan LM		19.36(0.00)	40.07(0.00)	31.65(0.00)	22.39(0.00)	39.50(0.00)	33.73(0.00)	22.63(0.00)	39.67(0.00)	34.03(0.00)

Notes: All estimations are Random Effects regressions with cluster robust standard errors. z statistics in parentheses.
RSQ is the coefficient of determination. Sargan-Hansen is a test statistic to select between FE and RE; overidentifying restrictions, assumed under RE, hold under the null. The statistic is asymptotically distributed as chi-square with degrees of freedom equal to the number of restrictions (Baum, 2006: 201). Breusch-Pagan LM tests the null hypothesis of cross-equation error independence (that is pooled-OLS is to be preferred to RE), and is asymptotically distributed as chi-square with degrees of freedom equal to unity.
** p < 0.10, ** p < 0.05, *** p < 0.01*

Table 10 Robustness check – Panel regression results: RE estimations of social sector and public investment expenditures with ACTDSR

Dependent Variable = Logarithmic sector expenditure shares		**Estimation with MULTILATERAL AID**			**Estimation with BILATERAL AID**			**Estimation with DAC AID**		
	Unit	4a. Education	5a. Health	6a. Public Investment	4b. Education	5b. Health	6b. Public Investment	4c. Education	5c. Health	6c. Public Investment
ACTDSR	Ln	-0.140***	-0.074**	0.064	-0.138***	-0.065**	0.052	-0.140***	-0.065**	0.053
		(-2.60)	(-2.21)	(1.46)	(-3.12)	(-2.00)	(1.47)	(-3.17)	(-1.98)	(1.47)
Aid share of GDP	Ln	-0.030	0.059	0.213***	0.061	0.035	0.155*	0.074	0.030	0.148*
		(-0.46)	(1.21)	(2.83)	(0.71)	(0.66)	(1.90)	(0.90)	(0.60)	(1.85)
PCGNI	Ln	-0.181	-0.048	0.060	-0.126	-0.054	-0.001	-0.120	-0.056	-0.004
		(-1.26)	(-0.35)	(0.57)	(-0.90)	(-0.41)	(-0.01)	(-0.85)	(-0.43)	(-0.04)
GOVEFF	[-2.5,2.5]	0.262***	0.161	0.147*	0.222**	0.197*	0.199**	0.215**	0.199**	0.201**
		(2.64)	(1.44)	(1.72)	(2.43)	(1.95)	(2.44)	(2.42)	(1.99)	(2.49)
AGEDEP	Ln	-1.029	-0.039	-0.459	-1.058	-0.006	-0.309	-1.041	-0.007	-0.299
		(-1.52)	(-0.09)	(-0.95)	(-1.57)	(-0.01)	(-0.60)	(-1.53)	(-0.02)	(-0.58)
ETHNIC	[0,1]	-0.515*	-0.347	0.127	-0.526*	-0.375	-0.012	-0.535*	-0.375	-0.013
		(-1.80)	(-1.21)	(0.45)	(-1.69)	(-1.33)	(-0.04)	(-1.69)	(-1.33)	(-0.04)
Constant		9.242***	2.998	4.771**	8.887***	2.937	4.631*	8.754**	2.962	4.619*
		(2.70)	(1.22)	(2.05)	(2.58)	(1.19)	(1.90)	(2.52)	(1.20)	(1.91)
Observations		84	107	100	85	108	101	85	108	101
RSQ		0.290	0.288	0.243	0.234	0.284	0.185	0.225	0.282	0.181
Sargan-Hansen		4.41(0.49)	5.84(0.32)	8.93(0.11)	6.44(0.27)	5.90(0.32)	8.14(0.15)	6.53(0.26)	5.99(0.31)	8.26(0.14)
Breusch-Pagan LM		19.02(0.00)	20.89(0.00)	33.49(0.00)	21.95(0.00)	23.51(0.00)	35.51(0.00)	22.28(0.00)	23.60(0.00)	35.72(0.00)

Notes: All estimations are Random Effects regressions with cluster robust standard errors. z statistics in parentheses.
RSQ is the coefficient of determination. Sargan-Hansen is a test statistic to select between FE and RE; overidentifying restrictions, assumed under RE, hold under the null. The statistic is asymptotically distributed as chi-square with degrees of freedom equal to the number of restrictions (Baum, 2006: 201). Breusch-Pagan LM tests the null hypothesis of cross-equation error independence (that is pooled-OLS is to be preferred to RE), and is asymptotically distributed as chi-square with degrees of freedom equal to unity.
** p < 0.10, ** p < 0.05, *** p < 0.01*

6. Summary and conclusions

The current global financial and economic crises are expected to adversely affect poor countries in SSA both through a financial channel, represented by the likely fall in ODA, and via a trade channel, following shrinking volumes of exports. Despite the better economic performance of many of these countries currently as compared to previous economic crises, facilitated by good fundamentals built between 2004 and 2008, fiscal cautiousness is nonetheless advised in order to avert the risk of unsustainable debt burdens. Such burdens have been shown in previous studies to be especially significant for public expenditure allocation, with constrained debt servicing reducing spending shares in the social sectors of education and health. Yet, such social spending could be critical for poverty reduction.

Based on a 1995-2009 panel of 40 SSA countries, of which 29 are HIPC-eligible, this paper investigates the extent to which debt servicing has continued to be consequential for public expenditure allocation following the HIPC initiative, which was intended to reduce external debt to sustainable levels. In particular, does constraining debt servicing lead to reallocation away from education and health to the same degree as was observed prior to HIPC? Furthermore, the paper examines the impact of external aid on the health and education spending as well as on public investment, another sector with potentially important implications for poverty.

Results show that debt servicing continues to exhibit a negative impact especially on education expenditure; this is particularly the case for the predicted debt-servicing, which arguably constitutes the more reliable measure of the liquidity constraint caused by debt repayment obligations. Nonetheless, our results also suggest that following the HIPC initiative the actual debt servicing has now become a more reliable indicator of the debt burden than previously. Furthermore, the debt impacts on both education and health expenditures are, respectively, much smaller than those for the pre-HIPC period. Similarly, the effect of ODA on education or health expenditure is now quite minimal; indeed, none of the estimates is significant, contrary to previous findings for the pre-HIPC period. However, we also find that foreign aid, especially multilateral aid, exhibits a positive effect on public investment, to the same degree as in earlier studies for the pre-HIPC period.

Among other covariates, ethnic fractionalization redirects public expenditure away from the social sector and, possibly, towards public investment. Moreover, government effectiveness generally benefits spending on both human and physical capital.

With respect to the variables constituting the paper's focus, the above results suggest that the HIPC initiative has succeeded in making debt levels more manageable for countries, at least for the purposes of public expenditure allocation. Unfortunately, we also found that the debt-reduction impact of HIPC is likely to be temporary, with the debt-servicing rate rising after approximately six years following a typical HIPC country's DP achievement. Thus, appropriate measures are called for to counterbalance such a direction. In the meantime, the likely downward trends in ODA, especially given the detrimental effects of the present crises on the development partners' economies, are worrisome if public investment is to endure, at least for poverty-reduction purposes.

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Appendix

Variables in the DSR and the expenditure estimations; Data sources and summary statistics

Variable	Description	Unit	Obs.	Mean	Std. Dev.	Min.	Max	Source
ACTDSR	Actual debt service, share of exports	Percentage	155	10.76	9.60	0.11	49.60	World Bank (2011)
NETDEBTX	Net debt, share of exports	Percentage	139	371.85	480.94	-29.39	2,447.09	(ibid.)
Yrs98_00	Year dummy* (Years 1998-2000)	'1' for 1998-2000, '0' otherwise	200			0	1	
Yrs01_03	Year dummy (Years 2001-2003)	'1' for 2001-2003, '0' otherwise	200			0	1	
Yrs04_06	Year dummy (Years 2004-2006)	'1' for 2004-2006, '0' otherwise	200			0	1	
Yrs07_09	Year dummy (Years 2007-2009)	'1' for 2007-2009, '0' otherwise	200			0	1	
HIPC_DP	HIPC Decision-Point country dummy	'0' before the achievement of the DP, '1' thereafter	200	0.43	0.50	0	1	United Nations (2011)
HIPCDPYrs	N. of years from the achievement of the Decision Point (DP) under the HIPC initiative	'0' before the achievement of the DP, a positive integer thereafter	200	2.15	3.17	0	9.83	(ibid.)
HIPCDPYrs^2	Ibid., squared	Positive integer	200	14.65	26.82	0	96.69	(ibid.)
Education	Share of government expenditure on education	Percentage	133	15.84	5.52	3.34	30.12	World Bank (2010a, 2011)
Health	Share of government expenditure on health	Percentage	189	9.15	3.49	1.94	20.35	(ibid.)
Public Investment	Share of government expenditure on public investment	Percentage	163	33.61	12.52	5.81	70.42	(ibid.)

(PTO)

Variables in the DSR and the expenditure estimations; Data sources and summary statistics (cont.)

Variable	Description	Unit	Obs.	Mean	Std. Dev.	Min.	Max	Source
ODAGDP	Official development assistance (ODA), share of Gross Domestic Product (GDP)	Percentage	193	13.62	10.56	0.39	53.09	(ibid.)
Multilateral Aid	ODA from multilateral agencies, share of GDP	Percentage	192	6.01	5.78	0.15	43.87	Organization for Economic Cooperation and Development (2011)
Bilateral Aid	ODA from Development Assistance Committee (DAC) and non-DAC countries, share of GDP	Percentage	193	8.00	7.20	0.15	56.85	(ibid.)
DAC Aid	ODA from DAC countries, share of GDP	Percentage	193	7.91	7.11	0.15	55.72	(ibid.)
PCGNI	Gross national income (GNI) per capita	Constant 2000 US$	155	372.30	295.13	72.18	1,690.95	World Bank (2010a, 2011)
GOVEFF	Government Effectiveness	[-2.5,2.5]	188	-0.88	0.50	-2.39	0.39	World Bank (2010b)
AGEDEP	Age dependency ratio for people younger than 15 and older than 64	Percentage	200	88.60	7.88	70.32	109.16	World Bank (2011)
ETHNIC	Ethnic Fractionalization	[0,1]	195	0.68	0.23	0.00	0.93	Alesina et al. (2003)

*Notes: * We exclude the base period Yrs95-97 (Years 1995-1997) from the estimation of DSR.*
Source of descriptive statistics: Authors' compilation.